characterization of mitochondrial proteome in pathophysiological conditions

rita ferreira, rui vitorino, renato alves, ana padrão, pedro domingues, rosário domingues, francisco amado

department of chemistry & QOPNA, university of aveiro

Lifestyle is a key modulator of the aging process. We have shown that lifelong physical activity prevents age-induced loss of mitochondrial functionality in skeletal muscle by preventing oxidative damage of mitochondrial proteins. Indeed, the decreased capacity for ATP production observed in aged mice seems to be related with the increased carbonylation of specific proteins, particularly metabolic ones. The attenuation of these effects by lifelong physical activity suggests new connections between molecular age-related changes and cellular functions known to be impaired in aged muscle.

Being mitochondria a pivotal organelle in the signalling and bioenergetic processes of tissues like the striated muscle (cardiac and skeletal), we have shown the importance of subcellular location in mitochondrial plasticity. Using proteomics of mitochondria and its subfractions, we have identified 325 distinct proteins, most of which from the functional clusters of oxidative phosphorylation, metabolism and signal transduction. Compared to the mitochondria located near the sarcolemma (SS), mitochondria interspersed in the myofibrils (IMF) expressed higher levels of proteins associated with oxidative phosphorylation and have higher respiratory chain complexes activity. This observation suggests a specialization of IMF mitochondria toward energy production for contractile activity. Functional differences between IMF and SS mitochondria were also related with distinct membrane proteins susceptibility to oxidative damage, being SS mitochondrial proteins more prone to carbonylation. Therefore, mitochondria localization in the fiber also determines protein's susceptibility to posttranslational modifications.